Vernon E. Brock, Director of the Division of Fish and Game, entered on his present position late in August of 1944, after experience as biologist of the Oregon State Fish Commission and as Administrator of Fishery Production and Production Analyst in the Office of Fishery Coordination, U. S. Department of the Interior. He holds an A. B. and M. A. from Stanford University. He was loaned to the Fish and Wildlife Service to take charge of the cooperative fisheries program with the U. S. Navy for Operations Crossroads.

World War II had a profound effect upon the work of the Division of Fish and Game. The Division's large bird farm was completely liquidated shortly after the start of the war; experimental fish ponds were discontinued; commercial fishing was greatly curtailed; all hunting was prohibited for security reasons for two years. The Director of the Division having retired, its curtailed work was carried on under direction of the Board's Executive Secretary.

Shortly before the start of the 1944-46 biennium, the present Director was appointed, and reorganization of the Division was begun.

As war pressures moved Westward, fishing and hunting drew increased interest. The coming of peace brought further change in the problem of the division, and a greatly increased work load.

THE RECONVERSION PERIOD

Recovery of Commercial Fishing

During the first half of the biennium, the Division of Fish and Game devoted nearly undivided attention to assistance to the fishing industry in reestablishing itself. Progress was made in obtaining relaxation of Naval restrictions and thereby increasing areas in which fishermen might work. The release of several aku boats which had been used by the Navy was obtained. The Division also worked with several Federal agencies in screening applications of fishermen for materials and labor, and was able to aid fishermen in presenting their cases.

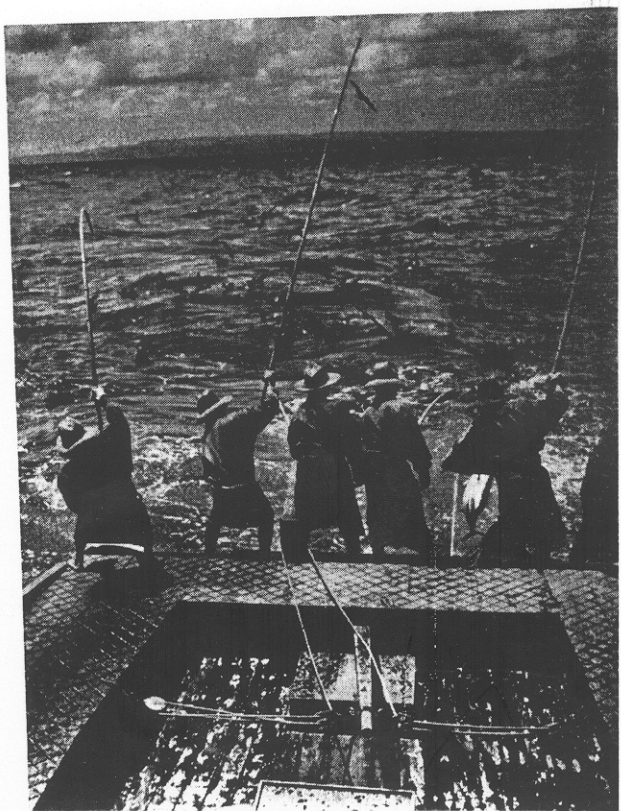
Improvement of fishing conditions was reflected in catch increases, particularly after June, 1945, when, by reason of mounting public protests and the greatly improved military situation, the numerous military regulations restricting the operation of fishing craft were either lifted or greatly eased.

The effect upon the commercial fish landings of the easement of these restrictions is clearly indicated by the comparison of the total catch for the territory for June of 1945 and July of the same year. The catch for June was 370,931 pounds, while the catch for July was 881,175 pounds, an increase of 232 per cent. While some of this surprisingly rapid increase may be attributed to the normal improvement of fishing during the summer months, nevertheless, the previous summer, that of 1944, was not markedly better than the following winter's catch (1944-45).

It is likely that the military regulations in force until the middle of 1945 served to reduce the monthly landings by more than 200,000 pounds —an amount which should supply at least 6,500 persons with one meal of fish each day for the period considered.

The catch continued on a high level throughout the 1945-46 year, and monthly catches near the close of the biennium were the largest since December, 1941. The chart on page 50 and the figures in Table 14 give details on the monthly catches. Tables 15 and 16 show the increase in commercial fishing licenses and permits.

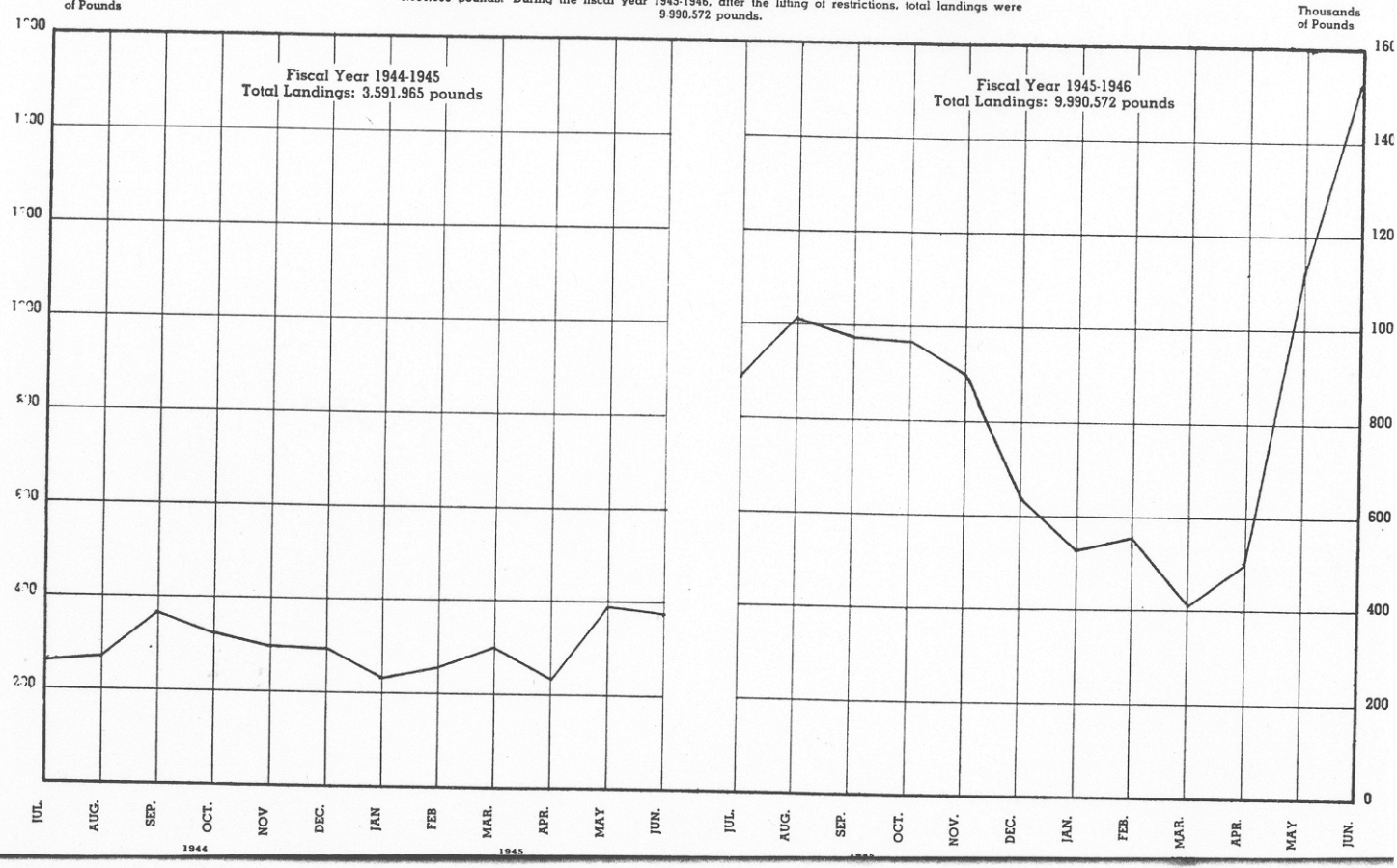
However, a marked decrease in the production of fish ponds had taken place, and on Oahu, where the ponds were the largest and most productive, they failed to make the same recovery as the offshore fisheries. Before World War II, Oahu had at least 25 fish ponds in operation. At the end of the biennium, only three large ones were submitting fish reports, and their catch was only about 30 per cent of the former total production. Some of the biggest, near Pearl Harbor, were filled in.



Aid in developing the tuna industry, Hawaii's most important fishery resource, is part of the program of the Division of Fish and Game. Here are aku fishermen in action; the third man from the right has just made a catch; and the noddy terns hovering over the surface indicate a good-sized school has been found. —(Photo by Photo Hawaii)

MONTHLY COMMERCIAL FISH LANDINGS IN THE TERRITORY

During the fiscal year 1944-1945, when most of the war time restrictions were in effect, total landings were 3.591,965 pounds. During the fiscal year 1945-1946, after the lifting of restrictions, total landings were 9 990.572 pounds.



Return of Sport Fishing and Hunting

The marked increase of interest in hunting and sport fishing throughout the Territory is reflected in the sale of licenses as shown in Tables 17 and 18. The increase in number over the preceding biennium was 300 per cent. With more people participating in these sports, an additional burden was placed upon the wardens. The number of arrests for violations of fish and game laws showed a great increase. See Table 19.

Reorganization of Warden Service

With the end of the war, an intensive survey of the fish and game patrol service was undertaken with a view to reorganization of the service to bring it up to date.

It had been recognized even before the start of the war that the set-up was outmoded. The size and organization of personnel and operational procedure are very little different from what they were about two decades ago when the service was mandated to the Board of Agriculture and Forestry. There was only one more warden than in 1927 to handle a greatly increased patrolling load.

Over the two decades, many noteworthy changes had a direct bearing on the activities of the patrol service, such as the enormous increase in population, the extensive construction of new roads opening up many areas heretofore inaccessible, the big improvement in local and inter-island transportation facilities, cutting down distances, and the modernization of fishing crafts, affording a greater operating radius.

Although there have been many new roads built, there are still large portions of the coastline inaccessible to our wardens. This makes the supervision of fishing activities difficult, and probably can be remedied only by use of patrol boats.

Of the total Island coastline, 528.3 miles are accessible by land, and 388.2 are inaccessible.

Somewhat more than a third of this inaccessible area is on the Island of Hawaii, where 141.1 miles of coastline are accessible and 146.1 inaccessible. This is largely due to the geographical formation of the island and the large areas of aa lava. More than a third is on the islands of Niihau, Lanai and Kahoolawe, which are wholly inaccessible to our wardens, being privately owned.

The situation on other islands is as follows:

	Inaccessible	Accessible
Kauai	18.7	88.2
Oahu	6.6	145.7
Maui	21.6	94.8
Molokai	43.2	58.5

While the war brought a decrease of hunting and fishing, the end of hostilities meant a rapid return of these activities in a greatly expanded scale, both in commercial fishing and in sport fishing and hunting. This fact further emphasizes the need of a thorough reorganization of the service.

One of the basic matters to be given serious attention is the tendency to minimize the character and importance of a warden's position. A warden's hours are long and irregular, and his duties are varied.

Plans for reorganizing and revitalizing the service were under way at the end of the biennium.

As a means of obtaining more satisfactory personnel, the division drew up a set of minimum requirements which the Territorial Civil Service Commission incorporated into future warden examinations.

A Supervising Warden was appointed to oversee the work of the service, and a Senior Warden was named for the Island of Hawaii in a step towards decentralization of the work.

A training program for wardens was instituted, with a view to instructing them in fish and game laws, the techniques of making an arrest and obtaining evidence, and general wildlife conservation principles. An effort is being made to have the wardens recognized in their communities as a source of information and help to sportsmen rather than mere enforcement officers.

A Wardens' Handbook was prepared by the Supervising Warden and a Wardens' School was conducted.

As a further step towards decentralization of the service, wardens have been authorized to sell fishing and hunting licenses in their districts. Formerly these were issued by the Board's headquarters in Honolulu.

Besides making the purchase of licenses more convenient, several other steps have been taken for the benefit of sportsmen. A handbook containing the text of fish and game laws has been published and is given to the recipient of hunting or commercial fish license at the time the license fee is paid. Additional copies are sold by wardens at a low cost.

A program of planned publicity has been undertaken to inform the public of fish and game laws, regulations, and open seasons and to educate the public in the importance of wildlife conservation. The newspapers have cooperated by using a series of articles submitted to them.

FISHERIES RESEARCH

Statistics

The importance of the statistical portion of the division's work is not adequately appreciated by most persons, for accurate data on the amount of fish caught, the kinds of fish caught, and the time and place of capture will supply, when properly analyzed, information bearing on many problems both biological and administrative.

The trend of the landings from a fishery for a given species over a number of seasons is the best indication whether or not that fishery is depleting the species. If such depletion is evident to the point of endangering the future supply, then remedies must be sought, usually through proper legislative action to protect the future supply. Such remedies may take the form of laws to prevent the taking of young, to prevent fishing on spawning or nursery areas, a closed season to prevent capture of adults during the spawning season, or others, as the combined information from the fisheries statistician and fisheries biologist would indicate most feasible.

The collection and compilation of fisheries statistics will also permit questions of many other kinds to be answered, such as what the relative worth of the various Hawaiian fisheries may be, what is the value of our fisheries and whether or not that value is increasing or decreasing with the passage of time, what areas are most productive and what species are taken in them, and many others. For a rational administration of the fisheries, such questions and others must be answered.

Despite the fundamental importance of complete and accurate statistics in picturing our fisheries resources and in planning legislation, the Territory has been forced in the past to rely on the opinion and general observation of fishermen.

An excellent survey of the fisheries resources of the islands was made by Cobb in 1900, but his are the only reliable statistics available prior to 1925.

In 1925, the Territorial Legislature enacted a law requiring Hilo and Honolulu dealers to report fish catches. The statistics compiled during the last two decades as a result of this legislation has proven of value, but there are two main faults with the figures.

First, they are incomplete, in that only Hilo and Honolulu reported. We estimate, on the basis of figures obtained during the last biennium, that they represented only from two thirds to three quarters of the total catch. They give no exact indication of where fish were caught, and no information on catches landed on the Islands of Maui, Kauai, Molokai and Lanai, or in outlying parts of Hawaii and Oahu.

Secondly, fishermen know better than the dealers where, when and how the fish were caught, and hence should be the main reporting agent.

The last legislature rectified the situation by making changes in the law whereby reports are required from all fish dealers in the territory, as well as from the owners of licensed fishing craft. Figures from the two sources serve as a check on completeness and accuracy.

A more detailed system of compiling and analyzing these reports has been installed. This system permits the accumulation of data that was lost by the system previously employed and makes possible biometrical analyses of a sort that were formerly impossible.

For instance, we can now compute the average weight of fish in a given area, and can recognize possible overfishing by a consistent decrease in size or number of the fish. We can more accurately measure abundance or changes in abundance of an exploited population of fishes. We can compare one fishing area with another. We can follow short term fluctuations, and this may be of importance when studying the beginning or end of a run of fish.

Regardless of the artificial drop in catch as a result of wartime conditions, there has been a significant change in the catch of certain species of fish in island waters. A number of species have dropped to a consistently lower level. The change points to the probable need of legislation to protect these species and enable them to make a comeback in abundance.

Statistics, however, are only half of the picture. Biological research is the other half, and is necessary in order to complete the picture and provide a proper basis for recommendations.

Biological Research

The biological research program for Territorial waters has proceeded slowly, due to the inability of obtaining trained personnel, proper equipment, and a research vessel.

Observations at Bikini.—The Director of the Division was loaned to the Fish and Wildlife Service, U. S. Department of Interior, to lead the research work coincident with the atom bomb experiments at Bikini. The information obtained on fish populations and fishing conditions in the Western Pacific through this first-hand experience will be useful to fishing interests in the Territory who propose to exploit these Western fisheries.

Schools of yellow fin tuna or ahi were noted in the Northern Marshalls in a fair degree of abundance. Bait, which is essential for the establishment of a commercial fishing industry as it cannot be carried economically any considerable distance, also appeared to be present, becoming increasingly abundant with the advent of summer.

Labor suitable for cannery work appears non existent, leading to the conclusion that development of a fishing industry in the Marshalls would not include establishment of shore canneries. Any development would probably take one of three forms: 1, Use of cannery ships equipped to can as well as catch; 2, establishment of freezing plants on shore, from which a refrigerated ship would gather fish at intervals for transportation to a Hawaiian cannery; or, 3, use of large tuna clippers with small freezing plants aboard.

Whether the tuna possibilities of the Marshalls or of other Western Pacific areas will be exploited depends to a large extent on whether fisheries resources nearer Hawaii or the Pacific Coast are depleted. While it is impossible to predict with accuracy the possibilities of a fishing area until it is exploited by commercial fishermen, it seems reasonable to believe that there are important fisheries resources stretching out from Hawaii which will be gradually developed. The observations in Bikini and catches made at less remote French Frigate Shoals and elsewhere should be the beginning of more detailed studies of this economic resource.

Many conferences and an active correspondence were carried on with agencies and persons interested in developing the fisheries of the Western Pacific in an effort to obtain the passage by Congress of a bill which will permit the federal Fish and Wildlife Service, U. S. Department of Interior, to conduct extensive research in the Pacific adjacent to the Hawaiian Islands. The bill was not passed by Congress, but may be reintroduced later.

Ahi and A'u Studies.—A detailed statistical study of the yellow fin tuna (ahi) and marlin (a'u) landed at Kona was undertaken. This study has as its objectives (1) to define, statistically, the morphological characteristics of Hawaiian yellow fin tuna and marlin, that is, their form and structure, in order to determine important differences between Hawaiian fish and the same species from other parts of the Pacific, and (2) to ascertain exactly what species are landed in the commercial fishery under the names ahi and a'u.

The first objective was not attained because of the relatively few fish that were landed and obtainable for study during the time available for this project.

However, certain rather interesting differences were discovered between the smaller yellow fin or ahi landed by the Hookena handline fishermen as compared with the larger ahi landed by the Kona flagline fishermen. These differences, principally in body proportions, appeared to be such as could be attributed to differences in age and growth.

The second objective was attained, and it was established that both ahi and a'u were often mixtures of species. This situation was not overly important so far as the ahi was concerned, since only an occasional individual of another species was landed as ahi. But landed under the name a'u were commonly two and occasionally five species. The most abundant species proved to be striped marlin (*Makaira grammatica*) which constituted about two thirds of the landing, while black marlin (*Makaira mazara*) made up practically all the remaining one third. In addition as occasional or rare components of the a'u catch, were short nosed spearfish (*Tetrapturus brevirostris*), sailfish, or a'u lepe (*Istiophorus orientalis*), and the broadbill swordfish (*Xiphias gladius*).

Key to Fishes of Hawaii.—The research project, "A Key to Fishes of Hawaii," was completed and a manuscript prepared. At present, the Key is being carefully tested by the actual identification of Hawaiian fishes as a means of discovering any errors that may exist. The completion and publication of this manuscript should make possible a ready yet precise identification of any Hawaiian fish, except a few that occur in water of great depth.

WILDLIFE RESEARCH

For many years before the war, one of the major activities of the Fish and Game Division was the maintenance of a game farm, which raised game birds for release in various parts of the islands. The game farm adjoined the Kaneohe Naval Air Base and was taken over by the Navy upon the outbreak of war and has never been re-established.

That the game farm served a purpose cannot be denied, since it was partially responsible for the initial plantings from which our present game populations have sprung. But while it also helped to strengthen populations badly depleted by overshooting, many of the areas chosen for release showed little consideration for selection of suitable habitat and as a result the birds failed to become established. The maintenance of a game farm was extremely costly, and subsequent to the achievement of its prime purpose of inoculation could not be justified further. It was realized here, as well as on the mainland, that continual plantings from stock raised on game farms to provide shooting was highly impractical when viewed in the light of recent research in game management. Unquestionably a sounder program based on environmental improvement would provide a more stable population that would offer better shooting.

Accordingly, a new approach to the problem was made with the reorganization of the Fish and Game Division near the end of the war.

hoped to be able to set up practical management practices which will increase the supply of upland game birds and to guide the degree of hunting pressure which should be permitted.

The initial step in the program in Hawaii was to find out what game species, potential and actual, are established on the islands, their ranges and number and what environmental factors influence their success or failure. By the end of the fiscal year in June 1946, practically all of the island of Hawaii had been surveyed. The accompanying table lists the game species found to be well established on Hawaii, their ranges and estimated numbers:

Species	Sq. Mi. Range	Estimated Total Population
Pheasants (ring-necked, Japanese and their hybrid)	2,049	32,300
California valley quail	1,498	58,100
Japanese painted quail	583	36,700
Chinese lace-necked dove	1,790	33,100
Pigeon (feral)	207*	2,300

* Feeding area only.

To illustrate one practical measure gained by such a population survey, it was found that the Japanese pheasant inhabited a more humid climate and forested area than the ring-neck. In the future, management practices will include consideration of this habitat preference. Another direct application of the population survey was the recommendation that a season be opened on valley quail in the fall of 1946 on the island of Hawaii in addition to Molokai, which was the only island where quail could be hunted in the past. Population studies showed a harvestable surplus to exist in this species.

In conjunction with the population and distribution investigations, attention was directed toward other factors influencing range requirements, with particular emphasis on food, cover, and water. Logically enough, it was found that the foods of a given species varied with altitudinal zonation of vegetation on the islands. What constituted a preferred food or cover plant at one altitude would be entirely supplanted by another in a different region. Thus, each area had to be viewed individually with respect to the plants utilized as food or cover in relation to its present game population. Plans for future management must be developed accordingly.

It has been conclusively demonstrated that certain land-use practices, particularly overgrazing, not only retard our wildlife populations but are also detrimental to our soil and our forests; these are all natural resources which must be zealously guarded and preserved.

At the conclusion of field investigations on the remaining islands, it is planned to initiate a comprehensive wildlife management program as the second phase of the federal aid in wildlife program aimed at environmental improvement in Hawaii. That area lying in the saddle between Mauna Loa and Mauna Kea and known as Pohakuloa area has been selected for the first one to receive attention.

TABLE 14

COMMERCIAL FISH LANDINGS BY SPECIES IN THE TERRITORY OF HAWAII DURING THE FISCAL YEARS, 1944-45 AND 1945-46

Species	1944-1945		1945-1946	
	Pounds	Value	Pounds	Value
Ahi	612,340	$150,100.91	1,116,683	$ 272,909.24
Aku	1,039,155	269,877.54	5,686,119	1,400,726.68
Akule	389,869	96,124.78	706,408	181,762.72
A'u	298,958	66,650.52	333,151	74,883.78
Awa	94,907	29,712.24	111,260	31,164.99
Crab	24,690	7,223.51	26,223	7,095.62
Kahala	53,075	19,899.66	328,346	117,993.53
Kawakawa	4,651	1,415.88	14,273	4,245.94
Lobster	38,153	20,434.26	30,024	16,945.97
Mahimahi	86,543	25,104.13	109,249	32,032.86
Moi	41,129	18,522.18	21,429	9,964.38
Mullet—Pond	24,530	12,442.48	23,214	10,825.61
Mullet—Sea	28,148	13,014.94	24,142	10,834.33
Oio	53,950	18,067.12	86,626	31,403.94
Ono	21,319	6,486.75	47,312	13,170.79
Opakapaka	16,551	5,939.62	59,498	21,987.25
Opelu	122,385	28,142.21	365,639	85,619.49
Opihi	11,621	3,410.44	7,766	2,335.22
Squid	29,249	12,561.46	14,838	4,850.43
Turtle	34,324	3,209.48	9,245	604.59
Ulua	115,653	54,765.21	240,874	95,475.16
Weke	50,633	24,052.96	44,872	18,149.03
Miscellaneous	400,132	107,677.30	583,381	176,838.41
Total	3,591,965	$994,835.58	9,990,572	$ 2,621,819.96

Aku (tuna) is by far the most important of the commercial fisheries resources of the islands. The extent to which military restrictions reduced aku fishing is shown in these figures. The catch of all fish was nearly three times as great in 1945-46 as in 1944-45, but the catch of aku was more than five times as great. These landings were all from waters adjacent to the main islands of the Hawaiian group.

TABLE 15

COMMERCIAL FISHING LICENSES

Type of License	Fiscal Year 1944-1945 No.	Fiscal Year 1944-1945 Amount	Fiscal Year 1945-1946 No.	Fiscal Year 1945-1946 Amount	Biennium 1944-1946 No.	Biennium 1944-1946 Amount	Previous Biennium 1942-1944 No.	Previous Biennium 1942-1944 Amount
Alien Commercial Fishing	73	$ 365.00	112	$ 560.00	185	$ 925.00	275	$ 1,375.00
Alien Employer Fishing	142	710.00	172	860.00	314	1,570.00	232	1,160.00
Alien Employee Fishing	668	3,340.00	1,029	5,145.00	1,697	8,485.00	1,246	6,230.00
Citizen Commercial Fishing	43	.....	52	.....	95	.....	126	.....
Citizen Employer Fishing	287	.....	413	.....	700	.....	513	.....
Citizen Employee Fishing	1,218	.....	1,618	.....	2,836	.....	2,088	.....
Alien Powerboat	109	646.00	153	885.75	262	1,531.75	118	669.55
Citizen Powerboat	266	1,818.75	376	2,870.50	642	4,689.25	355	2,537.50
Alien Rowboat	34	34.00	54	54.00	88	88.00	63	63.00
Citizen Rowboat	152	152.00	174	174.00	326	326.00	308	308.00
Number Plates Sold Commercial Fishermen	561	280.50	420	210.00	981	490.50	844	422.00
Identification Tags Commercial Fishermen	2,432	243.20	3,429	342.90	5,861	586.10	4,483	448.30
Total		$ 7,589.45		$11,102.15		$18,691.60		$13,213.35

TABLE 16

MISCELLANEOUS PERMITS, LICENSES AND SALES

Type of Permit or License	Fiscal Year 1944-1945 No.	Fiscal Year 1944-1945 Amount	1945-1946 Fiscal Year No.	1945-1946 Fiscal Year Amount	Biennium 1944-1946 No.	Biennium 1944-1946 Amount	Previous Biennium 1942-1944 No.	Previous Biennium 1942-1944 Amount
Mullet License—(Permits to sell pond mullet during closed season)	49	$ 245.00	39	$ 195.00	88	$ 440.00	129	$ 645.00
Lobster License—(Permit to sell lobster during closed season)	5	5.00	19	22.00	24	27.00	2	2.00
Game Bird Farmer's License	1	1.00	1	1.00	2	2.00	....	.....
Sale of Fish and Game Law Books	....	.....	223	55.75	223	55.75	....	.....
Total		$ 251.00		$ 273.75		$ 524.75		$ 647.00

TABLE 17

RECEIPTS FROM HUNTING LICENSES

	Fiscal Year 1944-1945	1945-1946 Fiscal Year	1944-1946 Biennium	Previous Biennium 1942-1944
Oahu County	$ 420.00	$ 2,395.00	$ 2,815.00	$ 420.00
Maui County	810.00	3,580.00	4,390.00	695.00
Hawaii County	1,745.00	3,840.00	5,585.00	2,990.00
Kauai County	865.00	4,190.00	5,055.00	1,690.00
Territorial	50.00	580.00	630.00	5.00
.....	$ 3,890.00	$14,585.00	$18,475.00	$ 5,800.00

TABLE 18

RECEIPTS FROM SPORT FISHING LICENSES

Types of License	Fiscal Year 1944-1945 No.	Fiscal Year 1944-1945 Amount	Fiscal Year 1945-1946 No.	Fiscal Year 1945-1946 Amount	Biennium 1944-1946 No.	Biennium 1944-1946 Amount	Previous Biennium 1942-1944 No.	Previous Biennium 1942-1944 Amount
Fresh Water Sport Fishing License	46	$ 115.00	23	$ 57.50	69	$ 172.50	69	$ 187.50
Night Angling License (Alien)	423	2,115.00	1,429	7,145.00	1,852	9,260.00	.....	.....
Throw Net License (Alien)	121	1,210.00	263	2,630.00	384	3,840.00	120	1,200.00
Identification Tags	544	54.40	1,692	169.20	2,236	223.60	120	12.00
		$ 3,494.40		$10,001.70		$13,496.10		$ 1,399.50

TABLE 19

ENFORCEMENT OF FISH AND GAME LAWS
FISCAL YEAR 1944-45

Warden District	Arrests	Convictions	Fines	Suspended Sentences	Bail Forfeitures	Total Amount
East Hawaii	23	11	$ 210.00	....	$ 190.00	$ 400.00
West Hawaii-Kohala	4	3	.....	....	50.00	50.00
West Hawaii-Kona	12	1	35.00	....	25.00	60.00
Kauai	23	20	575.00	1	75.00	650.00
Maui	35	33	485.00	5	.....	485.00
Molokai	9	5	80.00	....	55.00	135.00
Oahu	13	10	110.00	7	.....	110.00
Total	119	83	$1,495.00	13	$ 395.00	$1,890.00

FISCAL YEAR 1945-46

East Hawaii	38	10	$ 50.00	6	$ 515.00	$ 565.00
West Hawaii-Kohala	13	12	120.00	6	50.00	170.00
West Hawaii-Kona	2	....	.....	....	40.00	40.00
Kauai	27	19	487.50	....	25.00	512.50
Maui	31	23	235.00	....	70.00	305.00
Molokai	18	10	150.00	....	50.00	200.00
Oahu	63	50	735.00	6	100.00	835.00
Total	192	124	$1,777.50	18	$ 850.00	$2,627.50

BIENNIUM 1944-46

Totals	311	207	$3,272.50	31	$1,245.00	$4,517.50

PREVIOUS BIENNIUM 1942-44

Totals	232	179	$3,227.00	....	$ 880.00	$4,107.00

Thousands of tree seedlings are raised in the Board's Nursery in Makiki Valley for planting on Oahu Forest Reserves. Similar nurseries are in operation on all islands.